

**COMPARATIVE STUDY OF SPERMATHECAE IN ELEVEN  
*RHAMMATOCERUS* SAUSSURE 1861 GRASSHOPPER SPECIES  
(ORTHOPTERA: ACRIDIDAE: GOMPHOCERINAE: SCYLLININI)**

CRISTIANE VIEIRA DE ASSIS-PUJOL AND MICHEL LECOQ

(CVAP) Museu Nacional, UFRJ, Departamento de Entomologia, Quinta da Boa Vista, São Cristóvão, 29.940-040, Rio de Janeiro, Brazil (e-mail: cpujol@acd.ufrj.br); (ML) Centre de coopération internationale en recherche agronomique pour le développement, Prifas, BP 5035, 34032, Montpellier Cedex 1, France (e-mail: lecoq@cirad.fr)

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*Abstract.*—The spermathecae of 11 *Rhammatocerus* Saussure 1861 grasshopper species are described [*R. brasiliensis* (Bruner 1904), *R. brunneri* (Giglio-Tos 1895), *R. cyanipes* (Fabricius 1775), *R. guerrai* Assis-Pujol, 1997, *R. palustris* Carbonell 1988, *R. pictus* (Bruner 1900), *R. pratensis* (Bruner 1904), *R. pseudocyanipes* Assis-Pujol 1997, *R. schistocercoides* (Rehn 1906), *R. suffusus* (Rehn 1906) and *R. viatorius viatorius* (Saussure 1861)]. This taxonomic character, which has never been assessed in the tribe Scyllinini, is critical for determining grasshopper species. It also may be helpful in a taxonomic reclassification of species and provide a basis for reviewing the genus *Rhammatocerus* and the entire tribe Scyllinini.

*Key Words:* Acrididae, Scyllinini, *Rhammatocerus*, spermatheca

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In most taxonomic analyses of acridians, the phallic complex is the main morphological character used to distinguish species (Dirsh 1956, 1961). However, this character sometimes proves impracticable, e.g., for diagnosing some Gomphocerinae genera (Carbonell 1995). In such cases, the female genitalia, especially the spermatheca, may provide a basis for determination. Slifer (1939) described this distinguishing feature for many acridian species, and to a lesser extent by Dirsh (1957) and other authors, but these studies are almost solely descriptive. Spermatheca design has never been used as a basis for a review of current taxonomic groups. Nevertheless, as early as 1939, Slifer (1939) stated that the spermatheca would be a relevant criterion for determining families and subfamilies. Uvarov (1966) point out that the distal part of the spermathecal duct is subject to considerable

variations, characteristic for some taxonomic groups. Amedegnato (in litt.) noted that the spermatheca and diverticula are useful diagnostic characters and could even provide a basis for a phylogenetic reclassification. However, Dirsh (1957) regard the spermatheca as a subsidiary taxonomic character of the higher categories to be used with caution. In fact, very few studies have been carried out to assess the potential relevance of spermatheca design for differentiating species within an Acrididae genus.

Grasshoppers of the genus *Rhammatocerus* Saussure 1861 are distributed from southern USA to Argentina (Otte 1981). This group is characterized by high intra-specific variation and a relatively heterogeneous external morphology. The economic impact of these grasshoppers has increased markedly over the last 15 years in Brazil and other South American countries,

especially in Colombia (Lecoq and Assis-Pujol 1998), where they devastate many different crops and pastures (Cardenas and Devia 1995, Guagliumi 1958, 1959, 1962, 1973, Carbonell 1988, Lecoq and Balança 1998, Lecoq and Pierozzi Jr 1994, 1995a, b, Lecoq et al. 1997, León 1996, Martinez and Gomez 1996, Miranda et al. 1996).

Very few taxonomic studies have been carried out on *Rhammatocerus*. Since this genus was first described the most noteworthy studies on the genus were by Jago (1971) and Carbonell (1995), but no taxonomic revisions were involved. There are currently 13 species included in the genus (Carbonell 1995, Assis-Pujol 1997a, b, c, 1998, 1999). Most of them are known only from the original descriptions, which are generally ill-defined and based on characters that cannot be readily used or compared. Moreover, some studies have been carried out without reference to previous articles on the genus, which has led to considerable synonymy, erroneous species identifications and misinterpretations of geographical distributions. These latter species are currently distinguished on the basis of pigmentation features, which is a serious constraint for accurate identifications, i.e., pigmentation is often unclear on type specimens, due partly to poor preservation conditions. A critical problem with using color is also that it varies within a species as shown clearly in *R. schistocercoides* for which color change from brown to green with sexual maturation (Lecoq and Pierozzi Jr., 1996).

As part of a general project to revise *Rhammatocerus* (Assis-Pujol 1997a), we attempted to pinpoint relevant diagnostic criteria for species identification. It was found that interspecific morphological differences in male genitalia are so minor, or even non-existent, that they are unsuitable for species determination (Assis-Pujol 1997a). However, internal female genitalia, especially the spermatheca, were found to be a critical taxonomic character. Here we present a comparative analysis of the spermatheca.

## MATERIALS AND METHODS

Spermathecae of 11 of the 13 species currently included in *Rhammatocerus* were studied. Specimens of *R. varipes* (Bruner 1905) and *R. alticola* (Hebard 1923) were not available. The 264 female specimens analyzed were obtained from the following institutions: Facultad de Ciencias Naturales y Museo, La Plata, Argentina (FCNM); Museu Nacional do Rio de Janeiro, Brazil (MNRJ); Universidade Federal de Pernambuco, Brazil (UFPE); Universidade Federal Rural de Rio de Janeiro (UFRRJ); Coleção Entomológica Costa Lima, Universidade Federal Rural do Rio de Janeiro, Brazil (CECL); and Facultad de Ciencias, Universidad de Montevideo, Uruguay (FCUM). A detailed list of specimens studied is given for each species.

We adopt the terminology of Slifer (1939). Spermathecae were dissected and carefully prepared according to the following technique. The specimens were placed in a wet chamber for 24–36 h. Once softened, the abdomen was cut off at the 6th segment and a longitudinal incision was made along the intersegmental abdominal membrane. The spermatheca was removed and incubated in a 10% potassium hydroxide solution (KOH) for 24 h. It was then washed to remove all KOH in a solution containing 10 ml acetic acid/100 ml 70% alcohol. All tissues surrounding the spermatheca were removed, and it was then washed and incubated for about 24 h in a Mercurochrome/70% alcohol solution (1:10 v/v) in order to stain the structures. The spermatheca was washed again in water and placed between a glass slide and a coverslip in a drop of glycerine. All spermathecae illustrations were made with a camera lucida under a dissecting microscope ( $\times 50$ ). After dissection, the abdomen was dried and put with the specimen. The genitalia were placed in a microtube in glycerine alongside the specimen after the analysis.

## RESULTS AND DISCUSSION

The general morphology of *Rhammatocerus* spermathecae was found to be in line

with that described by Slifer (1939) for Acrididae spermathecae. All of them have a well-developed preapical diverticulum (PD) and a distinct apical diverticulum (AD) (Figs. 1–11). Spermatheca of the different species studied are described below.

*Rhammatocerus brasiliensis* (Bruner 1904)

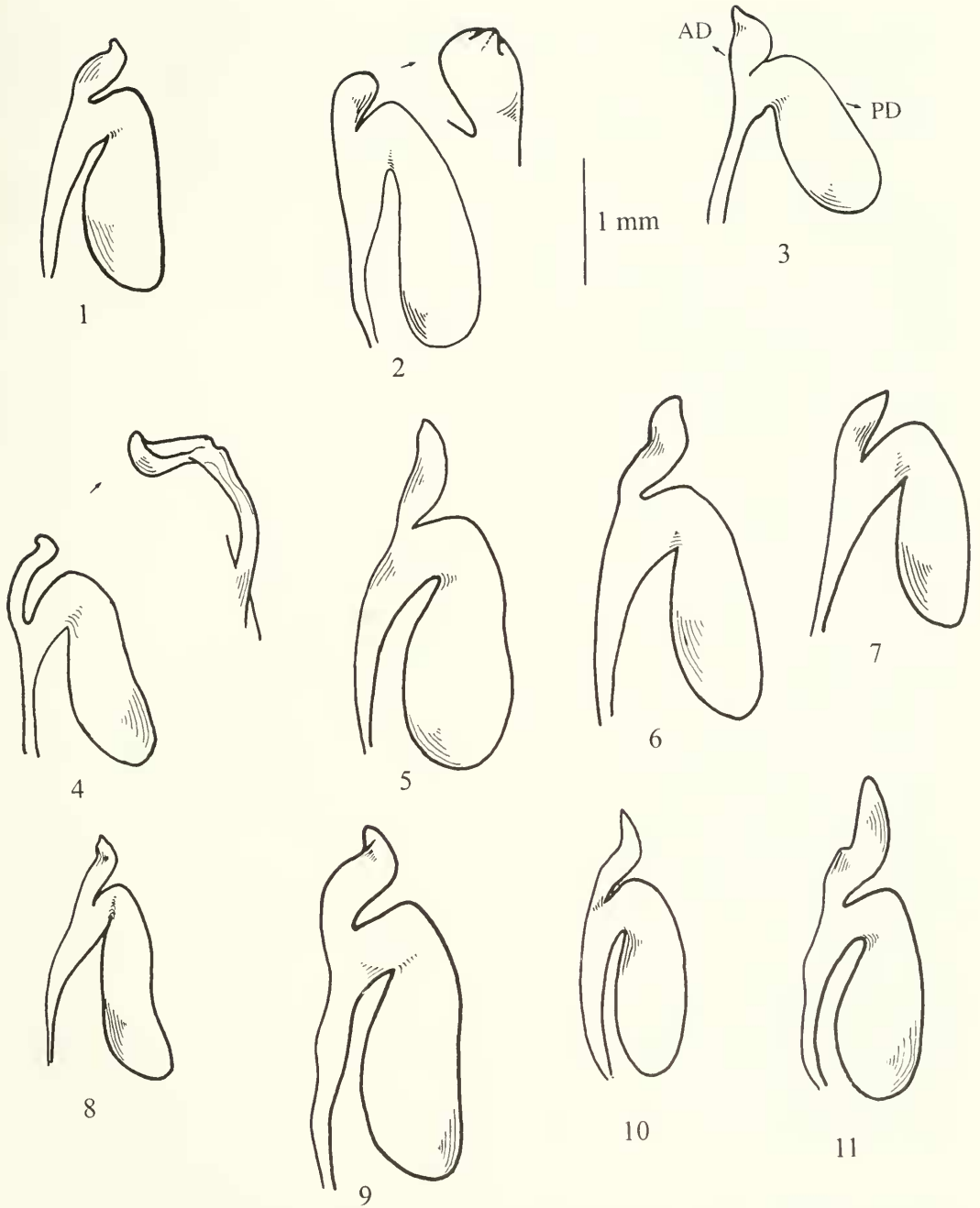
Material.—BRASIL, PARÁ: Santarém, V.1978, M. V. Cerdeira, 3, MNRJ; bidos, IV.1978, B. Silva, 1, MNRJ; Rio Grande do Norte: Jancico, I.1952, M. Alvarenga, 1, MNRJ; PARAÍBA: Brandão, Santa Luzia, 08.XII.1955, A. G. A. Silva, 2, MNRJ; Joazeirinho, Soledade, VII.1956, A. G. A. Silva, 1, MNRJ; PERNAMBUCO: Araripina, VI.1993, M. J. S. Lopes & C. S. Carbonell, 1, FCUM; Bonito, I.1978, B. Silva, 2, MNRJ; Serra das Russas, BR 232, Km 75 (cerca de Gravat), VI.1993, M. J. S. Lopes & C. S. Carbonell, 3, UFPE; 8 Km E de Sanharó, 30.IV.1991, C. S. Carbonell & M. J. S. Lopes, 14, UFPE; ESPÍRITO SANTO: Cariacica, XII.1977, B. Silva, 1, MNRJ; MINAS GERAIS: Diamantina, XI.1977, Seabra, Roppa & Monné, 3, MNRJ; Águas Vermelhas, X.1977, O. Roppa, 5, MNRJ; Águas Vermelhas, Curral de Dentro, XI.1977, O. Roppa, 1, MNRJ; Curvelo, VII.1977, Seabra, Roppa & Monné, 1, MNRJ; Pirapora, XI.1977, Seabra, Roppa & Monné, 2, MNRJ; GOAÍS: Minaçú, 29.V.04.VI.1987, Monné & Roppa, 1, MNRJ; Mineiros, II.1979, Roppa & Silva, 1, MNRJ; SÃO PAULO: Piracicaba, 19.X.1961, A. Mesa, 2, FCUM.; Piracicaba, Volta Grande, 4.V.1962, A. Mesa, 2, FCUM; Indaiatuba, 22.XI.1961, A. Mesa, 2, FCUM; Mato Grosso: Diamantino, BR 364, Km 348, II.1978, B. Silva, 1, MNRJ; MATO GROSSO DO SUL: Campo Grande, 08.XI.1952, M. Alvarenga, 1, MNRJ; RIO GRANDE DO SUL: Tramandaí, 14.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 2, FCUM; PARAGUAI, CENTRAL: Luque, 03.III.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 1, FCUM; PARAGUARÍ: Paraguairí, 10.III.1965, C. S. Carbonell, A. Mesa & M.

A. Monné, 8, FCUM; CAAGUAZÚ: 40 Km N de Caaguazú, Ruta Caaguazú, Yhú, 13.III.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 3, FCUM; ARGENTINA, SALTA: San Lorenzo, 20.I.1965, A. Mesa & R. Sandulski, 1, FCUM; P. del Carmen, 22.I.1936, F. Langman col., 1, FCNM; BUENOS AIRES: San Nicolas, 15–20.I.1949, Sonia Rivas leg., 2, FCNM; SANTIAGO DEL ESTERO: Beltrán, 8.XI.1941, Maldonado col., 1, FCNM.

Description of spermatheca.—Short preapical diverticulum, about 1.6 mm in length; apical diverticulum short, about  $\frac{1}{3}$  as long as preapical diverticulum, with its tip oriented in opposite direction relative to that of former structure (Fig. 1).

*Rhammatocerus bruneri* (Giglio-Tos 1895)

Material.—BRASIL, GOIÁS: Minaçu, 7.X.1987, Monné & Roppa, 1, MNRJ. SÃO PAULO: Serra da Bocaina, 1660 m, S. J. Barreiro, IV.1978, Seabra, Monné & Roppa, 1, MNRJ. Mato Grosso: Chapada, março, Bruner cln, Ex. Carn. Mus., A.N.S.P., 1, FCUM. BR 364, KM 616, II.1978, B. Silva, 1, MNRJ; MINAS GERAIS: Varginha, II.1955, F. M. Oliveira, 1, UFRRJ; RIO GRANDE DO SUL: 5, 33 km N de Passo Fundo, 25.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 1, FCUM; Pelotas, 14.II.1962, C. Biezanko, 1, FCUM; Santa Maria, 5.I.1955, E. Corseuil, 02676, 1, FCUM; Ronda Alta, 24.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 3, FCUM; Tramandaí, 14.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 1, FCUM. URUGUAI, LAVALLEJA: Alredores Pueblo Sauce, 22.II.1953, C. S. Carbonell, 1, FCUM; RIVERA: Cuchilla Cuñapirú, 21.I.1956, C. S. Carbonell, 4, FCUM; Sierra de La Aurora, 14.III.1961, C. S. Carbonell, A. Mesa & P. San Martin, 3, FCUM. PARAGUAI, CAAGUAZÚ: Caaguazú, 12.III.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 1, FCUM; 40 Km N de Caaguazú, Ruta Caaguazú, Yhu, 13.III.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 4,



Figs. 1-11. Spermathecae. 1, *Rhammatocerus brasiliensis*. 2, *R. brunneri*. 3, *R. cyanipes*. 4, *R. guerrai*. 5, *R. palustris*. 6, *R. pictus*. 7, *R. pratensis*. 8, *R. pseudocyanipes*. 9, *R. schistocercoides*. 10, *R. suffusus*. 11, *R. viatorius viatorius*. Abbreviations: DA = apical diverticulum; DP = preapical diverticulum.

FCUM; Sapucay, 26.XII.1904, Foster, 1, FCUM; 26.I.1905, Foster, 1, FCUM. ARGENTINA, MISIONES: Caraguatay, I.1960, Ronderos & Trotta col., 1, FCNM; CHACO: Resistencia, 20.III.1939, Denier col., 1, FCNM.

Description of spermatheca.—Long preapical diverticulum, about 2.0 mm in length; very short rounded apical diverticulum (less than  $\frac{1}{4}$  length of preapical diverticulum) with its tip oriented towards posterior part of spermatheca (Fig. 2) (if we consider anterior region with preapical diverticulum on right side of observer and apical diverticulum on left side, as indicated on Figs. 1–11).

*Rhammatocerus cyanipes* (Fabricius 1775)

Material.—COLOMBIA, SANTA MARTA: Valencia (Alt. 500 ft.), 08.VIII.1920, F. M. Gaige col., 2, FCNM.

Description of spermatheca.—Very short preapical diverticulum, about 1.0 mm in length; long apical diverticulum (if compared with preapical diverticulum), with its tip oriented slightly in opposite direction relative to that of former structure (Fig. 3).

*Rhammatocerus guerrai* Assis-Pujol 1997

Material.—Paratype: 1, BRASIL, MATO GROSSO: Campo Novo do Parecis, 08.V.1996, C. Pujol, W. Guerra & O. Ribeiro, MNRJ.

Description of spermatheca.—Short preapical diverticulum, about 1.6 mm in length; very long, thin and sinuous apical diverticulum about half as long as preapical diverticulum, with its tip oriented in opposite direction relative to that of former structure (Fig. 4).

*Rhammatocerus palustris* Carbonell 1988

Material.—BRASIL, MATO GROSSO: Chapada dos Guimarães, 25.I.1972, Ronderos & Carbonell, 2, FCNM; GOIÁS: Minaçú, M. A. Monné e O. Roppa, 1, MNRJ; MATO GROSSO: Chapada dos Guimarães, Fevereiro, 24–25, 1972, M. Descamps, 2, MNRJ; same locality, July,

1983, O. Roppa & M. A. Monné, 1, MNRJ; GOIÁS: Jataí, MNRJ. PARAGUAI, CAAGUAZÚ: 40 km N. de Caaguazú (at present Ihú), Março, 1965, C. S. Carbonell, A. Mesa & M. A. Monné, 2, MNRJ.

Description of spermatheca.—Long preapical diverticulum, about 2 mm in length; long apical diverticulum slightly shorter than half of preapical diverticulum, with its tip oriented slightly in opposite direction relative to that of former structure (Fig. 5).

*Rhammatocerus pictus* (Bruner 1900)

Material.—BRASIL, RIO GRANDE DO SUL: Lagoa Vermelha, 18.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 3, FCUM; Nonoai, 20.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 1, FCUM; Ronda Alta, 24.II.1964, C. S. Carbonell, A. Mesa & M. A. Monné, 2, FCUM; Palmeira das Missies, II. 1978, O. Roppa, 1, MNRJ. URUGUAI, ARTIGAS: Arroyo Tres Cruces Grandes (Potrero Sucio), 12, 14.II.1955, Fac. de Hum. Y Cienc., 5, FCUM; Arroyo Tres Cruces, Timbauba, 14.II.1955, F. de H. Y Ciencias, 2, FCUM; Bella Unión, 28.I.1952, L. C. Zolessi, 3, FCUM; Yacaré, 21.I.1952, F. de H. Y Ciencias, 1, FCUM; Canelones: Las Piedras, 20.III.1964, 1, FCUM; Las Piedras, 5, 6.II.1966, A. Carmenes, 2, FCUM; Las Piedras, 15.II.1966, A. Carmenes, 2, FCUM; Lavalleja: Cercanías Pueblo Sauce, 22.II.1953, C. S. Carbonell, 2, FCUM; Paysandú: Puerto Pepeaji, IV.1954, C. S. Carbonell, 1, FCUM; Rivera: Cerro Chato Dorado, 23.III.1963, A. Mesa & C. S. Carbonell, 1, FCUM; Cuchilla Cunãpirú, 21.I.1956, C. S. Carbonell, 1, FCUM; Sierra de La Aurora, 14.III.1961, C. S. Carbonell, A. Mesa & P. San Martin, 1, FCUM. PARAGUAI, San Bernardino: 14.I.1939, Denier col., 1, FCNM. ARGENTINA, SANTIAGO DEL ESTERRO: Beltrán 8.XI.1941, Maldonado col., 1, FCNM; BUENOS AIRES: sd, J. Bosq col., 2, FCNM; 5.I.1907, P. Jorgensen, 1, FCNM; La Plata; sd, sc, 1, FCNM; Campo del Ciclo, I.1954, sc, 1, FCNM; CATAMARCA:

Andalgalá, 8.III.1962, Torres & Ferreyra col., 1, FCNM; CHACO: Resistencia, 20.III.1939, Denier col., 4, FCNM; CÓRDOBA: Alta Gracia, I. 1937, M. Birabén, 2, FCNM; Cabana, 12.III.1937, M. Birabén col., 1, FCNM; Oncativo, 17.I.1959, Birabén & Scott leg., 2, FCNM; Rio Los Saucés, 28.II.1942, Maldonado col., 1, FCNM; Rio Tercero, 14.II.1942, Birabén col., 3, FCNM; Tanti, III.1968, Bulla & Grosso leg., 1, FCNM; Corrientes: 15–30.II.1959, M. Birabén col., 1, FCNM; Manantiales, II.1946, Birabén col., 1, FCNM; 1–10.III.1959, Birabén col., 1, FCNM; LA RIOJA: Famatina, 22.II.1959, Torres & Gardella col., 1, FCNM; JUJUY: Yala, 12.III.1939, Birabén & Scott leg., 1, FCNM; Reyes, 11.II.1939, Birabén & Scott leg., 1, FCNM; La Pampa: 10 Km W de Rancul, I.III.1973, A. Mesa & E. Cabella, 1, MNRJ; MISIONES: Cerro Corá, 18.III.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 1, FCUM; Seis Misiones, 10.II.1990, Balatti col., 1, FCNM; Parada Seis, 11.II.1990, Balatti col., 1, FCNM; SALTA: Abra Santa Laura, 11.III.1939, Birabén & Scott leg., 2 j, FCNM; Ciudad de Salta, 19.I.1965, A. Mesa & R. Sandulski, 1, FCUM; Juramento, 14.III.1939, Birabén & Scott leg., 1, FCNM; San Lorenzo, 20.I.1965, A. Mesa & R. Sandulski, 1, FCUM; San Lorenzo, 3.II.1965, A. Mesa & R. Sandulski, 5, FCUM; Tartagal, 29–31.I.1965, A. Mesa & R. Sandulski, 1, FCUM; SAN LUIS: Piedra Blanca, 19.III.1960, V. Sarmiento & Trotta, 1, FCNM; Rincon del Este, Comechingones, 19.III.1960, V. Sarmiento & Trotta col., 2, FCNM; Concarán, 16–17.III.1960, V. Sarmiento & Trotta col., 1, FCNM; Puerta Colorada, 14.III.1960, V. Sarmiento & Trotta, 1, FCNM; SANTA FÉ: Barrancas, 22.II.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 3, FCUM; Carcaraña, 21.II.1965, C. S. Carbonell, A. Mesa & M. A. Monné, 7, FCUM; LA RIOJA: Vinchina, 22.II.1959, Torres & Gardella col., 4, FCNM.

Description of spermatheca.—Long

preapical diverticulum, about 2 mm in length; long apical diverticulum, bent at mid length, slightly shorter than half of preapical diverticulum, with its tip oriented in opposite direction relative to that of preapical diverticulum (Fig. 6).

*Rhammatocerus pratensis* (Bruner 1904)

Material.—BRASIL, RIO GRANDE DO NORTE: Macaíba, VIII.1951, M. Alvarenga, 1, MNRJ; PERNAMBUCO: 12 Km N de Buíque, 30.X.1995, C. Ayres, 1, LGBE: 2422, UFPE; Serra das Russas, Km 116, 28.X.1995, C. Ayres, 1, LGBE:2019, UFPE; 9 km L de Salgueiro, 31.X.1995, C. Ayres, 1, UFPE.

Description of spermatheca.—Short preapical diverticulum, about 1.6 mm in length; straight apical diverticulum about  $\frac{1}{3}$  as long as preapical diverticulum, with its tip oriented almost in same direction relative to that of former structure (Fig. 7).

*Rhammatocerus pseudocyanipes* Assis-Pujol 1997

Material.—Paratype 1, BRASIL, SERGIPE: Areia Branca, 35 Km W de Aracaju, 19.II.1981, Roppa, Carbonell & Roberts, MNRJ; AMAZONAS: Humaitá, VIII.1980, G. S. Andrade, 1, MNRJ; MINAS GERAIS: Águas Vermelhas, X.1977, Seabra, Roppa & Monné, 1, MNRJ.

Description of spermatheca.—Short preapical diverticulum, about 1.5 mm in length; short apical diverticulum about  $\frac{1}{3}$  as long as preapical diverticulum, with its tip clearly oriented in opposite direction relative to that of former structure (Fig. 8).

*Rhammatocerus schistocercoides* (Rehn 1906)

Material.—BRASIL, MATO GROSSO: Gustavo Dutra, 25.X.1953, C. R. Gonçalves col., 1, UFRRJ; Serra do Roncador, Posto Pimentel Barbosa, 25.IX.1947, F. Meirelles col., 4, UFRRJ; Tangará da Serra, Dest. Alcool Branca, 22.VI.1947, R. C. Mauro, 3, MNRJ; GOIÁS: Aragarças, 2.VII.1953, H. Sick col., 1, UFRRJ; Margens do Rio Ar-

aguaia, 10.VII.1953, C. S. Carbonell, 2, FCUM; MINAS GERAIS: Sacramento, 30.IV.1996, G. W. Cosenza col., 3, MNRJ; Pedregulho, 30.IV.96, G. W. Cosenza col., 4, MNRJ. COLOMBIA, ARAUCA: Cravo Norte, 14.X.1996, M. Lecoq, J. A. Jimenez Gomez & O. J. Ramirez cols, 22, MNRJ.

Description of spermatheca.—Long preapical diverticulum, about 2.0 mm in length; long bulky apical diverticulum about  $\frac{1}{2}$  as long as preapical diverticulum, with its tip clearly oriented in opposite direction relative to that of former structure (Fig. 9).

*Rhammatocerus suffusus* (Rehn 1906)

Material.—BRAZIL, AMAZONAS: Humaitá, VIII.1980, G. S. Andrade, 1, MNRJ; RIO DE JANEIRO: Outubro, A.N.S.P., Ex. Carn. Mus., Bruner Cln, 1, FCUM; MINAS GERAIS: Corinto, XI.1977, Seabra, Roppa & Monné, 2, MNRJ; Curvelo, XI.1977, O. Roppa, 4, MNRJ; Gouveia, XI.1977, Seabra, Roppa & Monné, X.1982, L. Reys, 1, MNRJ; Minaçú, 23.V–04.VI.1987, Monné & Roppa, 1, MNRJ; MATO GROSSO: Chapada near Cuyabá, May, June, August, A.N.S.P., Ex. Carn. Mus., Bruner Cln., 2, FCUM. BOLÍVIA, SANTA CRUZ: Santa Cruz de la Sierra, 26.IX.1953, M. Alvarenga, 1, MNRJ.

Description of spermatheca.—Short preapical diverticulum, about 1.5 mm in length; long thin apical diverticulum slightly longer than half of preapical diverticulum, with its tip oriented slightly in opposite direction relative to that of former structure (Fig. 10).

*Rhammatocerus viatorius viatorius*  
(Saussure 1861)

Material.—MÉXICO, SINALOA: Rosario (J. A. Kusche), A.N.S.P. 1, FCUM; TECOJA: Jatate, Rio Chiapas, 1800 ft, III.1934, D. W. Amram Jr., 1, MNRJ. GUATEMALA, LA UNION: Zacapa, 85 m., 10.XI.1972, E. Welling, 1, MNRJ.

Description of spermatheca.—Short piri-form preapical diverticulum, about 1.6 mm

in length; extremely large apical diverticulum, about  $\frac{2}{3}$  of preapical diverticulum, scythe-shaped and its tip oriented in opposite direction relative to that of former structure (Fig. 11).

These 11 species can be pooled into four different groups on the basis of the above descriptions. Group 1 includes *R. brasiliensis*, *R. cyanipes*, *R. guerrai*, *R. pseudocyanipes*, *R. suffusus* and *R. viatorius viatorius*, characterized by a short preapical diverticulum (1.6 mm or less) and with the tip of the apical diverticulum oriented in the opposite direction relative to that of the preapical diverticulum (Figs. 1, 3, 4, 8, 10, 11). Group 2 includes only *R. pratensis* characterized by a short preapical diverticulum and an apical diverticulum oriented in the same direction (Fig. 7). Group 3 include *R. palustris*, *R. pictus*, and *R. schistocercoides* with a long preapical diverticulum and an apical diverticulum with its tip clearly oriented in the opposite direction relative to that of the preapical diverticulum (Figs. 5, 6, 9). Group 4 includes a single species, *R. bruneri*, with a long preapical diverticulum and an apical diverticulum with its tip oriented towards the posterior part of the spermatheca (Fig. 2).

#### CONCLUSION

This is the first attempt to distinguish Scyllinini grasshoppers on the basis of spermatheca design, and the results indicate that this character considerably facilitates identifications. This criterion should be helpful in a taxonomic revision, while overcoming the problem of making identifications based on external male genital morphology. The genus *Rhammatocerus* and the entire tribe Scyllinini could be better revised by conducting systematic diagnoses on the basis of classical characters including also spermathecal morphology.

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